CLAIMS

1. A remote, non-contact system for detecting a defect in a railroad wheel, said system comprising:

a remote means, located at a first specified location in the environment surrounding said wheel, for generating in a non-contact manner in said wheel an ultrasonic wave having a specified wavefront, said ultrasonic wave having a direct portion and reflected and transmitted portions if said direct portion encounters a defect in said wheel,

a non-contact means, located at a second specified location in said environment, for sensing from said wheel the acoustic signal emanating from said wheel that results from said ultrasonic wave traveling through said wheel,

a signal processing means, responsive to said sensed acoustic signal, capable of distinguishing whether said sensed signal has a component that indicates the existence of a portion chosen from the group consisting of reflected and transmitted portions in said ultrasonic wave.

wherein the presence of said component in said acoustic signal indicates the existence of a defect in said railroad wheel.

2. A defect detection system as recited in Claim 1, wherein said specified wavefront is chosen so as to yield said wave having frequencies that match the frequency sensing capabilities of said non-contact, sensing means.

3. A defect detection system as recited in Claim 1, wherein said ultrasonic wave generating means is modulated so as to yield said wave having frequencies that match the frequency sensing capabilities of said non-contact, sensing means.

4. A defect detection system as recited in Claim 2, wherein said ultrasonic wave generating means is modulatable so as to yield said wave having frequencies that match the frequency sensing capabilities of said non-contact, sensing means.

5. A defect detection system as recited in Claim 1, wherein said defect is of a specified type and said specified wavefront is chosen so as to enhance the sensitivity of said non-contact, sensing means to said specified type of defect.

6. A defect detection system as recited in Claim 1, wherein when said defect is a surface defect, said specified wavefront is generated with a formed laser source.

7. A remote, non-contact method for detecting a defect in a railroad wheel, said method comprising the steps of:

generating, in a non-contact manner in said railroad wheel an ultrasonic wave having a specified wavefront, said generated ultrasonic wave having a direct portion and reflected and transmitted portions if said direct portion encounters a defect in said wheel,

sensing from said railroad wheel the acoustic signal in the environment surrounding said wheel that emanates from said wheel as a result of said ultrasonic wave traveling through said wheel,

processing said sensed acoustic signal to determine whether said sensed signal has a component that indicates the existence of a portion chosen from the group consisting of reflected and transmitted portions in said ultrasonic wave,

wherein the presence of said component in said acoustic signal indicates the existence of a defect in said railroad wheel.

8. A defect detection method as recited in Claim 7, further comprising the step of choosing said specified wavefront so as to yield said ultrasonic wave having frequencies that match the frequency sensing capabilities encountered in said sensing step.

9. A defect detection method as recited in Claim 7, further comprising the step of choosing the frequency of said ultrasonic wave so that said chosen frequency is compatible with the frequency sensing capabilities encountered in said sensing step.

10. A defect detection method as recited in Claim 8, further comprising the step of choosing the frequency of said ultrasonic wave so that said chosen frequency is compatible with the frequency sensing capabilities encountered in said sensing step.

11. A defect detection method as recited in Claim 7, wherein said defect is of a specified type and said specified wavefront is chosen so as to enhance the signal sensitivity encountered in said sensing step to said specified type of defect.

12. A remote, non-contact system for detecting a defect in a railroad wheel, said system comprising:

a pulsed, laser light source, located at a first specified location in the environment surrounding said wheel, for generating in said wheel an ultrasonic wave, said ultrasonic wave having a direct portion and reflected and transmitted portions if said direct portion encounters a defect in said wheel,

an optical component in the path of the light from said light source for forming said light into a specified illumination pattern so that said generated ultrasonic wave has a specified wavefront,

an air-coupled transducer, located at a second specified location in said environment, for sensing from said wheel the acoustic signal emanating from said wheel that results from said ultrasonic wave traveling through said wheel,

a signal processor, responsive to said sensed acoustic signal, capable of distinguishing whether said sensed signal has a component that indicates the existence of a reflected portion in said ultrasonic wave,

wherein the presence of said component in said acoustic signal indicates the existence of a defect in said railroad wheel.

13. A defect detection system as recited in Claim 12, wherein said specified wavefront is chosen so as to yield said wave having frequencies that match the frequency sensing capabilities of said transducer.

14. A defect detection system as recited in Claim 12, wherein said pulsed laser is modulated so as to yield said wave having frequencies that match the frequency sensing capabilities of said transducer.

15. A defect detection system as recited in Claim 13, wherein said pulsed laser is modulated so as to yield said wave having frequencies that match the frequency sensing capabilities of said transducer.

16. A defect detection system as recited in Claim 12, wherein said defect is of a specified type and said specified wavefront is chosen so as to enhance the sensitivity of said transducer to said specified type of defect.

17. A defect detection system as recited in Claim 12, wherein said defect is a surface defect in a railroad wheel, and said controlled wavefront is generated with a formed laser source.